PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/30, H04B 7/26

A1

(11) International Publication Number: WO 99/30519

(43) International Publication Date: 17 June 1999 (17.06.99)

(21) International Application Number: PCT/FI98/00919

(22) International Filing Date: 23 November 1998 (23.11.98)

(30) Priority Data:
974310 24 November 1997 (24.11.97) FI

(71) Applicant (*for all designated States except US*): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): HOLMA, Harri [FI/FI]; Itätuulenkuja 1 B 32, FIN-02100 Espoo (FI). TOSKALA, Antti [FI/FI]; Katajaharjuntie 4 C 48, FIN-00200 Helsinki (FI).

(74) Agent: PATENTTITOIMISTO TEKNOPOLIS KOLSTER OY; c/o Kolster OY AB, Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

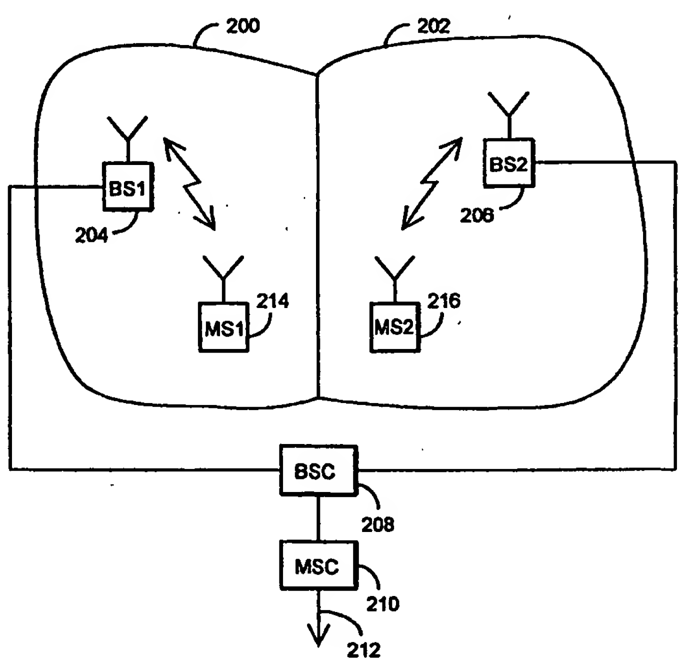
(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
In English translation (filed in Finnish).

(54) Title: BASE STATION SYNCHRONIZATION METHOD AND CELLULAR SYSTEM

(57) Abstract

The invention relates to a method for synchronizing base stations, and a cellular radio system comprising in each cell at least a base station (204, 206) and a number of terminals (214, 216). The base stations transmit a reference signal, and the terminals can simultaneously communicate with one or more base stations and simultaneously receive the reference signal from more than one base station. In order to easily synchronize the base station, the terminal measures the timing difference between a reference signal transmitted by a base station not communicating with the terminal and one or more reference signals transmitted from base stations communicating with the terminal. The terminal reports the measured difference to the one or more base stations communicating with the terminal. On the basis of the measured timing difference, the one or more base stations are arranged to adjust the timing of the signals they have transmitted to the terminal in relation to each other.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

BASE STATION SYNCHRONIZATION METHOD AND CELLULAR SYSTEM

FIELD OF THE INVENTION

The present invention relates to a method for synchronizing base stations in a cellular radio system which comprises in each cell at least a base station and a number of terminals, and in which method the base station transmits a reference signal, and the terminals can simultaneously communicate with one or more base stations and simultaneously receive the reference signal from more than one base station, and in which method the base stations and the terminals use a TDD method for communication, and in which method the connections between the base stations and the terminals comprise common channels and dedicated channels.

BACKGROUND OF THE INVENTION

Generally speaking, base stations of cellular radio systems may be either synchronous or asynchronous with respect to one another, depending on the system. In other words, signals of the base stations are either synchronous or asynchronous with respect to one another. In systems which enable terminals to simultaneously communicate with more than one base station, i.e. in which macrodiversity can be applied, it is preferable to synchronize the base stations with one another so as to enable the signals coming from several base stations to be easily received at the terminal. Systems applying a CDMA multiple access method provide an example of systems in which it is advantageous to apply macrodiversity.

In the CDMA method, a narrow-band data signal of a user is multiplied to a relatively wide band by a spreading code having a considerably wider band than the data signal. Known test systems use bandwidths such as 1.25 MHz, 10 MHz and 25 MHz. In connection with the multiplication, the data signal spreads over the entire band used. All users transmit by simultaneously using the same frequency band. A specific spreading code is used on each connection between a base station and a mobile station, and different user signals can be distinguished from one another at receivers on the basis of the user-specific spreading code. The aim is to select the spreading codes in such a way that they are orthogonal with respect to one another, i.e. do not correlate with one another.

Correlators in conventionally implemented CDMA receivers are synchronized with the desired signal which is recognized on the basis of the

spreading code. At the receiver, the data signal is restored to the original band by multiplying it again by the same spreading code as at the transmission stage. In an ideal case, the signals multiplied by some other spreading code do not correlate and are not restored to the narrow band. From the viewpoint of the desired signal, they thus appear as noise. The aim is thus to detect the signal of the desired user from the group of several interfering signals. In practice, the spreading codes correlate, and the signals of the other users make the detection of the desired signal difficult by distorting the received signal non-linearly. Such interference caused by different users to one another is called multiple-access interference.

In CDMA systems, the base stations usually transmit a reference signal by means of which the terminals recognize the transmission of the base station. This reference signal, or a pilot signal, is usually a data-unmodulated signal that is multiplied by a known spreading code.

Macrodiversity is easy to implement by CDMA technique. Two base stations, for example, then transmit a signal to one terminal. The terminal is able to receive and utilize the two signals. Correspondingly, in the other transmission direction, more than one base station can receive the transmission of the same terminal. In connection with the CDMA technique, macrodiversity is also referred to as soft handover. The terminal communicating with a first base station is approaching the border of a cell and gradually also starts receiving signals from the base station of a neighbouring cell. At the periphery of the cell, the terminal can simultaneously communicate with the two base stations, and when moving on deeper into the area of the latter base station, the terminal can gradually switch off the connection to the first base station. From the viewpoint of the user, handover between the base stations takes place unnoticed, and the signal quality remains good all the time.

Furthermore, systems applying a technique called TDD-CDMA require that transmissions of the base stations are synchronized with one another. Contrary to a FDD (Frequency Division Duplex) method in which different transmission directions are transmitted in their own frames at different frequencies, a TDD (Time Division Duplex) method divides a transmission frame in which a signal is transmitted between a transmitter and a receiver into two parts that are used in different transmission directions. The TDD technique is illustrated in Figure 1 presenting by way of example a feasible TDD frame. The frame is divided into two parts 100, 102, which are separated by a short guard

time 104. The first part 100 of the frame is used in transmission direction from base station to terminal, for example. The second part 102 of the frame is used in transmission direction from terminal to base station. Between the two parts is a relatively short guard time, during which no transmissions occur. The guard time is required because of a propagation delay in order that the transmissions of different transmission directions would not overlap.

In the TDD-CDMA system, the synchronization of the signals is essential in a situation in which the terminal simultaneously communicates with more than one base station. If the signals coming from the different base stations are not synchronous with respect to one another, and different parts of the TDD frame therefore overlap, then interference occurs between different transmission directions.

In prior art solutions, base stations are synchronized with one another mainly in two different manners. Firstly, synchronization can be achieved by allocating a common clock signal to all base stations. This requires a separate cabling for all base stations, which makes the synchronization expensive and difficult to implement. Secondly, the base stations can be provided with a GPS receiver which receives a clock signal transmitted by a satellite. This adds to the costs of the base station and is difficult to implement if the base station is located indoors.

BRIEF DESCRIPTION OF THE INVENTION

An object of the invention is to provide a method and a cellular radio system implementing the method so as to solve the above-mentioned problems. This is achieved by the method of the type presented in the introduction, which is characterized in that the terminal measures the timing difference of the reference signals it has received from the different base stations and reports it to one or more base stations, and that, on the basis of the measured timing difference, the one or more base stations adjust the timing of the common and the dedicated channels they have transmitted to the terminals.

The invention also relates to a method for synchronizing base stations in a cellular radio system which comprises in each cell at least a base station and a number of terminals, and which base station transmits a reference signal, and which terminals can simultaneously communicate with one or more base stations and simultaneously receive the reference signal from more than one base station, and the base stations and in which method the termi-

nals use a TDD method for communication. The method of the invention is characterized in that when the terminal receives a reference signal from the base station not communicating with it, the terminal measures the timing difference of the detected reference signal in relation to one or more reference signals from the base stations communicating with the terminal, and that it reports the measured difference to one or more base stations communicating with the terminal, and that, on the basis of the measured timing difference, the one or more base stations adjust the timing of the signals they have transmitted to the terminals with respect to each other.

The invention also relates to a cellular radio system comprising in each cell at least a base station and a number of terminals, and which base station is arranged to transmit a reference signal, and which terminals are arranged to simultaneously communicate with one or more base stations by using a TDD method and to simultaneously receive the reference signal form more than one base station. The system of the invention is characterized in that the terminal comprises means for measuring a timing difference between a reference signal transmitted by the base station not communicating with the terminal and one or more reference signals transmitted by the base stations communicating with the terminal, and means for reporting the measured difference to the one or more base stations communicating with the terminal, and that on the basis of the measured timing difference, the one or more base stations are arranged to adjust the timing of the signals they have transmitted to the terminal in relation to each other.

The preferred embodiments of the invention are disclosed in the dependent claims.

The method and system of the invention provide many advantages. With the help of the invention the base stations can be advantageously synchronized without additional equipments and arrangements required in connection with soft handovers. Synchronizations can always be performed in the event of handovers, and if no handovers occur for some time, and there is a risk of the base stations losing the common synchronization, then one of the terminals can be commanded to measure the timing difference between the pilot signals of the base stations.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in more detail by means of preferred embodiments with reference to the accompanying drawings, in which

Figure 1 shows the above-described example of a TDD frame,

Figure 2 illustrates an example of a cellular radio system to which the invention can be applied, and

Figure 3 shows the structure of a terminal of the system of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention can be applied to any cellular radio system in which base stations transmit a pilot signal or a reference signal corresponding thereto. In the present description, a cellular radio system using a TDD-CDMA method is used as an example, but the essential features of the invention are independent of the multiple access method used. Figure 2 illustrates an example of a cellular radio system to which the invention can be applied. The figure shows two adjacent cells 200, 202 of the radio system, each cell being served by a cell-specific base station 204, 206. The base stations communicate with a base station controller 208 which communicates with the rest of the telephone network via a mobile services switching centre 210.

Figure 2 also shows two subscriber terminals 214, 216. The first terminal 214 communicates with the first base station 204, and the second terminal communicates with the second base station 206. In other words, the connections in this example are implemented by TDD technique in which both transmission directions are on the same frequency band and by a CDMA multiple access method in which each connection has a specific spreading code for use. The two cells 200, 202 use the same frequency band. Now, if the transmissions of the base stations are not synchronous, then the transmissions of different transmission directions at different base stations possibly overlap in time. In that case, when the first terminal 214, for example, attempts to receive transmission from the first base station 204, then the second terminal 216 may simultaneously transmit a signal to the second base station 206, and the reception of the first terminal 214 in that case fails.

The connections between the base stations and the terminals comprise dedicated channels and common channels. The dedicated channels are

connection-specific channels, such as a speech channel or a control channel associated with it, for example. The common channels transmitted by the base station can be received by several terminals.

In the system of the invention, the base stations transmit a reference signal, or a pilot signal, which is in the CDMA system a data-unmodulated signal. In other words, in the example of Figure 2, the first and the second base station 204, 206 each transmits a pilot signal, and the terminals are able to separate these signals from each other. The pilot signal can be received over the entire coverage area of the base station. The terminals detect the pilot signal of the base station of a neighbouring cell particularly at the periphery of the cells. The terminals start measuring the intensity of the pilot signal for the purpose of a possibly forthcoming handover. Let us assume that the first terminal 214 has detected a pilot signal transmitted by the second base station 206. The terminal measures the timing difference of the pilot signals it has received from the first base station 204 and the second base station 206 and reports the measured result to the first base station 204 communicating with the terminal. The first base station 204 reports the timing difference measured by the terminal 214 to the second base station 206 via the base station controller 208, for example. On the basis of this information, the second base station 206 is able to adjust its timing to be congruent with the first base station 204. Alternatively, the base station 204 is able to adjust its timing to be congruent with the base station 206.

Base station areas generally comprise several terminals that move and simultaneously receive pilot signals of more than one base station and prepare or perform handover between the base stations. Adjusting synchronization requires only small modifications to the conventional soft handover, and the synchronization operation of the invention thus does not interfere with the normal operation of the terminal. Synchronization adjustment operation can be a continuous process ensuring that the clocks of the base stations do not lose the common synchronization. If no terminals performing handover exist at a given time, the base stations can command one of the terminals to perform the timing measurement.

Particularly in the TTD-CDMA systems, the base stations should be synchronized with an accuracy which prevents the signals from different transmission directions from overlapping more than a fraction of the length of a frame. If it is assumed that the length of the frame is 10 ms, for example, a

sufficient synchronization accuracy is within the range of 100-200 μs. Propagation delays of radio signals can be ignored in the present description, since the distance of 5 km, for example, only corresponds to a propagation delay of 17 μs.

The base station controller is able to arrange the base stations within its area into some kind of hierarchy according to which the base stations synchronize with one another. This helps the base stations to know which base station has to change its synchronization at a given time.

Let us next study Figure 3 showing a feasible structure of a terminal of the system of the invention by means of a block diagram. The terminal comprises an antenna 300 by means of which the received signal is applied via a filter 302 to radio frequency parts 304 converting the signal into an intermediate frequency. From the radio frequency parts 304 the signal is applied to a multiplier 306 multiplying the signal by the desired spreading code 308. From the multiplier the signal is further applied to decoding means 301 and further to other parts 322 of the receiver. The signal 324 to be transmitted in transmitting direction is applied to an encoder 312 performing channel encoding or a corresponding encoding, and further to a multiplier 314 multiplying the signal by a connection-specific spreading code 316. The multiplied signal is applied via radio frequency parts 318 and a filter 302 to the antenna 300. The terminal further comprises control means 320 controlling the operation of the other parts of the apparatus. The control means are preferably implemented by a processor and software suitable for the purpose. Figure 3 only shows the essential parts of the terminal. Naturally, the apparatus may also comprise other components, including filters, amplifiers, encoding means and decoding means, as it is obvious to those skilled in the art. Furthermore, the details of the structure of the apparatus may deviate from the above description, depending on the multiple access method used, for example. In the TDMA system, for example, the signal to be transmitted is not multiplied by a spreading code.

In the system of the invention, the terminal can receive a pilot signal from more than one base station. In that case, the received signal is multiplied by a spreading code used by the desired base station. The pilot signal is then detected from the total signal received.

In the system of the invention, the terminal comprises the means 320 for measuring the timing difference between a pilot signal transmitted by

the base station not communicating with the terminal and one or more reference signals transmitted from the base stations communicating with the terminal. The terminal comprises the means 320, 312 to 318 for reporting the measured difference to one or more base stations communicating with the terminal. The base stations of the system are arranged to adjust their timing on the basis of the timing difference measurement. The operations of the invention can preferably be implemented by software in the base stations of the system.

Although the invention is described above with reference to the example according to the accompanying drawings, it is obvious that the invention is not restricted thereto, but it can be modified in a variety of ways within the scope of the inventive idea disclosed in the attached claims.

CLAIMS

1. A method for synchronizing base stations in a cellular radio system which comprises in each cell at least a base station (204, 206) and a number of terminals (214, 216), and in which method the base station transmits a reference signal, and the terminals can simultaneously communicate with one or more base stations and simultaneously receive the reference signal from more than one base station, and in which method the base stations and the terminals use a TDD method for communication, and in which method the connections between the base stations and the terminals comprise common channels and dedicated channels, **characterized** in that the terminal measures the timing difference of the reference signals it has received from the different base stations and reports it to one or more base stations, and that, on the basis of the measured timing difference, the one or more base stations adjust the timing of the common and the dedicated channels they have transmitted to the terminals.

2. A method for syncronizing base stations in a cellular radio system which comprises in each cell at least a base station (204, 206) and a number of terminals (214, 216), and which base station transmits a reference signal, and which terminals can simultaneously communicate with one or more base stations and simultaneously receive the reference signal from more than one base station, and in which method the base stations and the terminals use a TDD method for communication, **characterized** in that when the terminal receives a reference signal from the base station not communicating with it, the terminal measures the timing difference of the detected reference signal in relation to one or more reference signals from the base stations communicating with the terminal, and that it reports the measured difference to one or more base stations communicating with the terminal, and that, on the basis of the measured timing difference, the one or more base stations adjust the timing of the signals they have transmitted to the terminals in relation to each other.

3. A method as claimed in claim 2, **characterized** in that the base station not communicating with the terminal adjusts, on the basis of the measured timing difference, the timing of the signals it has transmitted to the terminal.

4. A method as claimed in claim 1 or 2, **characterized** in that the terminal measures the timing difference of the reference signals at the request of the base station.

5. A method as claimed in claim 1 or 2, **characterized** in that the base stations and the terminals use a CDMA multiple access method for communication.

6. A method as claimed in claim 2, **characterized** in that one or more base stations communicating with the terminal transmit information about the timing difference to the base station the timing of whose reference signal the terminal measured.

7. A cellular radio system comprising in each cell at least a base station (204, 206) and a number of terminals (214, 216), and which base station is arranged to transmit a reference signal, and which terminals are arranged to simultaneously communicate with one or more base stations by using a TDD method and to simultaneously receive the reference signal form more than one base station, **characterized** in that the terminal comprises means (320) for measuring a timing difference between a reference signal transmitted by the base station not communicating with the terminal and one or more reference signals transmitted by the base stations communicating with the terminal, and means (320, 312 to 318) for reporting the measured difference to the one or more base stations communicating with the terminal, and that, on the basis of the measured timing difference, the one or more base stations are arranged to adjust the timing of the signals they have transmitted to the terminal in relation to each other.

8. A cellular radio system as claimed in claim 7, **characterized** in that one or more base stations communicating with the terminal are arranged to transmit information about the timing difference to the base station the timing of whose reference signal the terminal measured.

9. A cellular radio system as claimed in claim 7, **characterized** in that the base station not communicating with the terminal is arranged to adjust, on the basis of the measured timing difference, the timing of the signals it has transmitted to the terminal.

10. A cellular radio system as claimed in claim 7, **characterized** in that one or more base stations are arranged to adjust, on the basis of the measured timing difference, the timing of the common and the dedicated channels they have transmitted to the terminal in relation to each other.

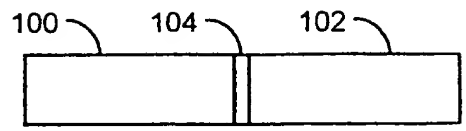

100
104
102

Fig. 1

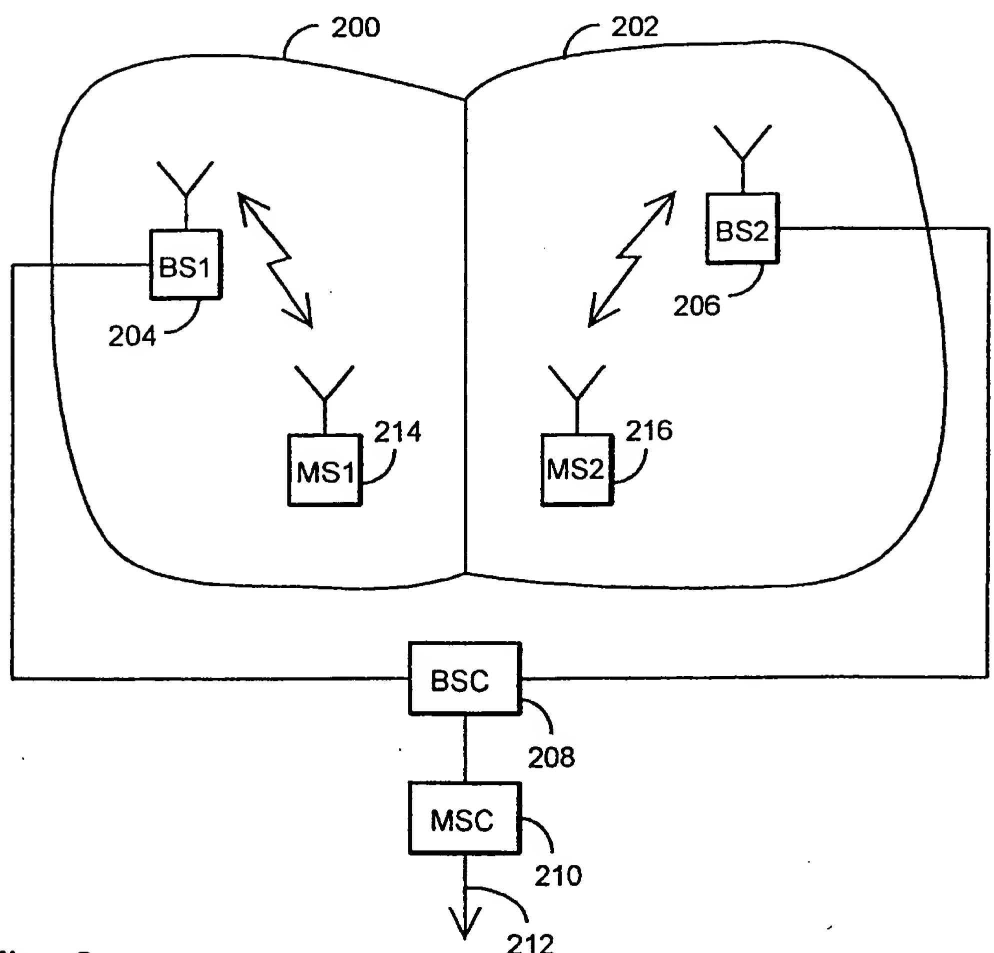

200
202
BS1
204
BS2
206
MS1
214
MS2
216
BSC
208
MSC
210
212

Fig. 2

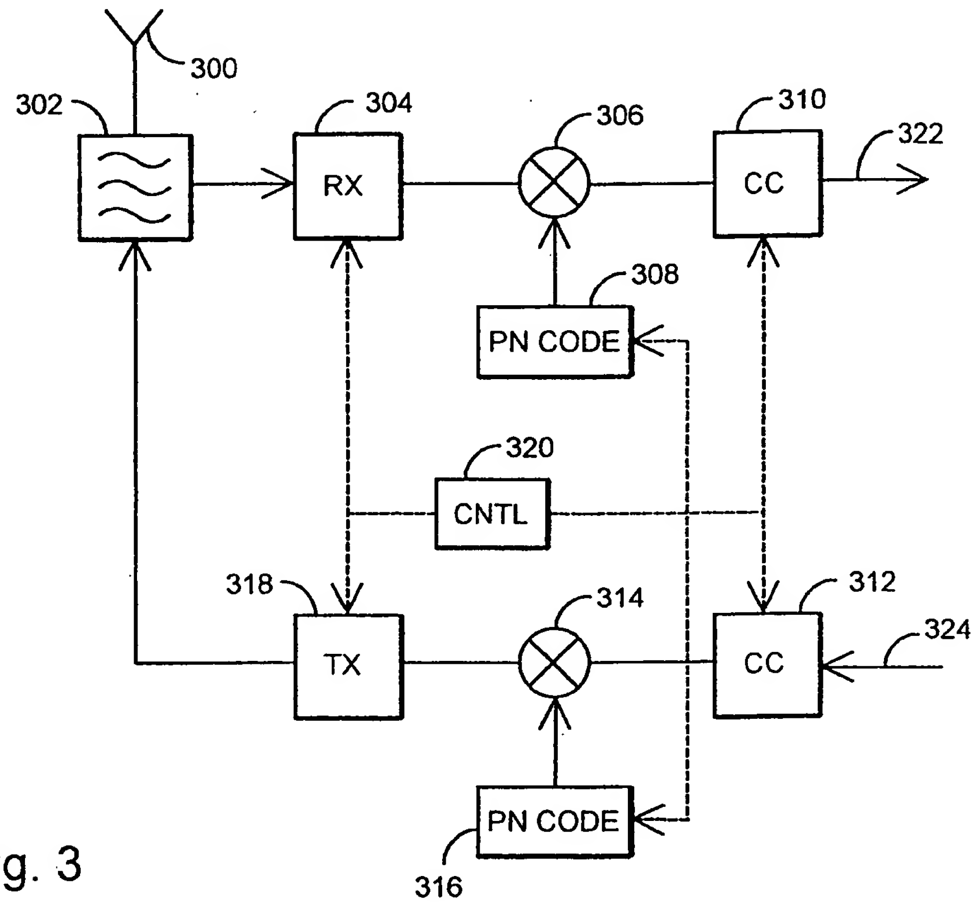

300
302
304
RX
306
310
CC
322
308
PN CODE
320
CNTL
318
TX
314
312
CC
324
PN CODE
316

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 98/00919

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/30, H04B 7/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 6334593 A (N T T IDOU TSUUSHINMOU KK), 2 December 1994 (02.12.94), abstract --	1
P,X	EP 0845877 A2 (OKI ELECTRIC INDUSTRY CO., LTD.), 3 June 1998 (03.06.98), column 3, line 24 - line 42; column 8, line 17 - line 40; column 12, line 40 - column 15, line 31, figure 5 --	1-10
A	WO 9430024 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 22 December 1994 (22.12.94), page 7, line 15 - page 8, line 17; page 12, line 27 - page 14, line 32; page 20, line 5 - line 20, figure 4 -- --------	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 May 1999	05-05-1999

Name and mailing address of the ISA/	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Jaana Raivio Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI 98/00919

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 6334593 A	02/12/94	NONE	
EP 0845877 A2	03/06/98	CN 1186398 A	01/07/98
		JP 10164650 A	19/06/98
		JP 10190616 A	21/07/98
WO 9430024 A1	22/12/94	AU 677079 B	10/04/97
		AU 7012994 A	03/01/95
		CA 2141445 A	22/12/94
		CN 1112385 A	22/11/95
		EP 0659326 A	28/06/95
		FI 950626 A	14/02/95
		JP 8500474 T	16/01/96
		NZ 267747 A	27/07/97
		US 5828659 A	27/10/98